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Rosemarie Contella
Name

Signature

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Patent Application Of: Brown et al.

For: Oxidized Titanium As A Cathodic Current Collector

the specification of which is being transmitted herewith

Assistant Commissioner of Patents
Washington, D.C. 20231

INFORMATION DISCLOSURE STATEMENT
Pursuant to 37 CFR 1.56

1. Applicants submit herewith patents, publications or other information of which they are aware, which they believe may be material to the examination of this application and in respect of which there may be a duty to disclose in accordance with 37 CFR 1.56.

The filing of this Information Disclosure Statement (IDS) shall not be construed as a representation that a search has been made (37 CFR 1.56(g)), an admission that the information cited is, or is considered to be material to patentability or that no other material information exists.

The filing of this IDS shall not be construed as an admission against interest in any manner (Notice of Jan. 9, 1992, 1135 O.G. 13-25, at 25).

2. Attached is Form PTO-1449. Legible copies of all items listed accompany this IDS.

3. A concise explanation of the possible relevance of the listed information items is as follows:

Patents:

U.S. Patent No. 3,499,782 to Shockley is directed to a substrate protective oxidized coating process. In Shockley, the substrate is for use in electrical circuits and must be impervious to corrosive acid materials. In the process, a thin film of suitable valve metal including titanium (column 1, lines 59 to 61) is deposited on the substrate. The thusly coated substrate structure is then placed in an elevated temperature oxidizing media environment for a sufficient time to attain a substantially complete conversion of the valve metal film to the oxide form. The specific process described at column 2, lines 23 to 29, calls for a pure oxygen atmosphere, at atmospheric pressure, within environmental temperature of approximately 500°C for approximately 10 hours.

U.S. Patent No, 4,411,825 to Domeniconi discloses a solid non-consumable current collector for an electrochemical cell. The current collector is composed of an elemental metal, such as titanium, and carbon, and the current collector is manufactured by forming a salt of the metal to be mixed with the carbon, dissolving the salt in a solvent to form a solution of the metal salt, wetting the carbon with a solution of the metal salt (such as titanium sulfate, nitrate, etc.) and reducing the metal salt to form the elemental metal. Although not necessary, after reduction, it may be desirable to expose the mixture to an oxidizing atmosphere to form a controlled oxide surface on the metal (column 3, lines 50 to 57).

U.S. Patent No. 4,181,754 to McKinzie et al. relates to a method of preparing titanium dioxide semiconductor photoactive

electrodes comprising the steps of: 1) applying to a titanium substrate a thin film of one or more oxide metals selected from the group consisting of aluminum and the d-electron transition metals other than titanium, and 2) heating the coated titanium body in an oxygen-containing atmosphere at an elevated temperature, preferably below about 800°C to sinter the coating to the titanium substrate. The sintering step produces on the titanium substrate a thin photoactive film of titanium dioxide containing a uniform concentration gradient of the previously applied modifying oxide.

U.S. Patent No. 5,114,432 to Plichta et al. discloses a method of making an electrode comprising forming a mixture of 80 to 90 weight percent of powdered cathode or anode active materials and 10 to 20 weight percent powdered electrolyte sale, spreading the mixture evenly onto an electrical current collector sheet or foil and then heating the sheet or foil under a dry inert gas atmosphere to a temperature at or near the melting point of the electrolyte salt. Typically, the heating is on the order of 10 to 15 minutes at 550°C.

U.S. Patent No. 5,185,182 to Brown discloses a means to prevent the formation of an oxide layer on a substrate during heating. More particularly, Brown teaches that it is necessary to provide a material adjacent to a metal or metal oxide film on a substrate in order to prevent the metal or metal oxide film on the substrate from further oxidation.

U.S. Patent No. 5,521,029 to Fiorino et al. is directed to substrates coated with an anti-corrosion layer containing sub-stoichiometric titanium oxide (titanium suboxide) for use as current collectors. The coating is formed from a colloidal mixture of titanium suboxide particles in pure distilled and deionized water. The substrate is immersed in the colloidal

mixture and when a voltage is applied, positively charged titanium suboxide particles migrate toward the substrate during electophoretic deposition. A positive surface charge on the titanium suboxide particles is provided by lowering the pH of the colloidal dispersion to about 1 to 3. Preferably, the current collector is for a lead acid battery and the titanium suboxide particles are deposited onto a lead-containing collector.

U.S. Patent No. 2,949,411 to Beck describes anodizing a titanium surface in an electrolyte comprised of an aqueous solution having a pH from 3 to 12 and containing at least two cations selected from the group consisting of the alkali metals and ammonium, and a phosphate anion in an amount of at least 70 grams per liter. At the beginning of the anodizing operation, the voltage ranges from 0 to about 10 volts, and as the resistance of the cell increases due to deposition of the oxide coating, the voltage is raised from about 40 to 60 volts or higher to maintain the desired amperage. The resulting articles are composed of titanium base alloys coated with aluminum, tin, chromium, vanadium, molybdenum, iron, manganese, and other elements, applied either singly or in combinations thereof.

U.S. Patent No. 3,346,469 to Weigel relates to a method of selectively coloring a titanium surface by electrolysis. The electrolysis occurs in an aqueous solution that may be composed of one or more of the following acids and bases: sulphuric acid, oxalic acid, acetic acid, nitric acid, hydrochloric acid, phosphoric acid, boric acid, ammonium hydroxide, sodium hydroxide, potassium hydroxide and sodium bicarbonate containing metals such as aluminum, copper and zinc dissolved therein.

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Inventor: Brown et al.

U.S. Patent No. 3,959,091 to Moji et al. is directed to forming porous, adhesion-promoting oxide coatings on titanium by anodizing in an aqueous solution containing fluoride ions and one or more of the oxidizing agents listed at column 4, lines 30 to 40, including oxylates. The anodizing process occurs at current densities of from 0.25 to 5 amp./ft^2.

U.S. Patent No. 4,091,970 to Fritz et al. discloses a process for making a titanium-supported lead electrode comprising immersing a body of titanium in a hot aqueous solution of an oxyhalide acid, absorptively coating the cleaned titanium body with a layer of titanium (IV) in a treatment bath consisting essentially of a boiling aqueous solution of a titanium salt followed by anodically coating the titanium body with PbO_2 by electrolysis.

U.S. Patent No. 5,160,599 to Kobayashi et al. relates to a process for coloring a titanium foil by anodizing an oxide film thereof. The foil is anodized in an electrolytic solution until the voltage reaches a predetermined level at a constant current density; temporarily cutting off the current supply to interrupt the anodizing; and then again supplying a direct current at a predetermined current density to continue the anodizing. The final color is adjusted by controlling the supplied amount of current without causing an increase in voltage.

U.S. Patent No. 5,211,832 to Cooper et al. discloses a process for producing an anodized film on titanium, wherein the anodization is performed in a solution consisting of liquid ortho-phosphoric acid of reduced water content and an aprotic solvent. Suitable aprotic solvents are listed on Table 2, column 2. The aprotic solvents provide for higher anodizing voltages and lower current leakage.

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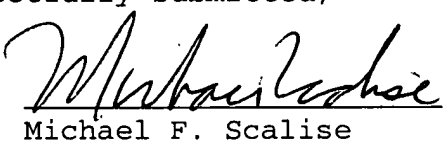
U.S. Patent No. 5,221,459 to Okano et al. provides a method of manufacturing a magnetic disc substrate made of titanium. The process consists of chemically etching the titanium disc to remove a surface thickness of at least 2 nm. The new surface is then anodized with a 0.1 vol% phosphoric acid-containing aqueous electrolyte using a pure titanium anode.

4. The remaining patents were cited by the Examiner in the parent application Serial No. 090/918,139, filed July 30, 2001.

5. The person making this statement is the agent who signs below, who makes this statement on the information supplied by the inventors and the information in the agent's file.

Respectfully submitted,

By: 

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet	7	of	7	Attorney Docket Number	37505.0278

Application Number	
Filing Date	
First Named Inventor	Brown et al.
Group Art Unit	
Examiner Name	

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No. 1	U.S. Patent Document Number	Kind Code 2 (if known)	Name of Patentee or Applicant of Cited Document	Date of Publication of Cited Document MM-DD-YYYY	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear
	1	3,499,782		Shockley	03-10-1970	
	2	4,411,825		Domeniconi	10-25-1983	
	3	4,181,754		McKinzie et al.	01-01-1980	
	4	5,114,432		Plichta et al.	05-19-1992	
	5	5,185,182		Brown	02-09-1993	
	6	5,521,029		Fiorino et al.	05-28-1996	
	7	2,949,411		Beck	08-16-1960	
	8	3,346,469		Weigel	10-10-1967	
	9	3,959,091		Moji et al.	05-25-1976	
	10	4,019,970		Fritz et al.	04-26-1977	
	11	5,160,599		Kobayashi et al.	11-03-1992	
	12	5,211,832		Cooper et al.	05-18-1993	
	13	5,221,459		Okano et al.	06-22-1993	
	14	4,391,729		Liang et al.	07-05-1983	
	15	5,114,810		Frysz et al.	05-19-1992	
	16	5,670,278		Disselbeck et al.	09-23-1997	

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No. 1	Foreign Patent Document Office3	Number4	Kind Code5 (if known)	Name of Patentee or Applicant of Cited Document	Date of Publication of Cited Document MM-DD-YYYY	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear	T6

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

1 Unique citation designation number. 2 See attached Kinds of U.S. Patent Documents. 3 Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). 4 For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. 5 Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. 6 Applicant is to place a check mark here if English language Translation is attached.